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UNITED STATES DEPARTMENT OF AGRICULTURE
AGRICULTURAL RESEARCH ADMINISTRATION
BUREAU OF ENTOMOLOGY AND PLANT QUARANTINE
DIVISION OF CEREAL AND FORAGE INSECT INVESTIGATIONS

EUROPEAN CORN BORER RESEARCH

PROGRAM FOR THE CALENDAR YEAR 1949

LIST OF PRINCIPAL COOPERATING AGENCIES

California:
- California Institute of Technology. (Translocation studies)

Canada:
- Dominion Parasite Laboratory. (Parasite colonization)

Connecticut;
- Connecticut Agricultural Experiment Station. (Surveys)

Delaware:
- Delaware Agricultural Experiment Station. (Surveys, Parasite field status)

Illinois:
- Illinois Natural History Survey. (Surveys, Parasite colonization and field status)
- Agricultural Experiment Station. (Surveys)

Indiana:
- State Department of Conservation. (Surveys)
- Purdue Agricultural Experiment Station. (Resistance investigations, Parasite colonization and field status, and surveys)

Iowa:
- Agricultural Experiment Station. (Surveys, insecticide and resistance investigations)
- State Department of Agriculture. (Parasite colonization and field status)

Kansas:
- Entomological Commission. (Surveys)

Kentucky:
- Agricultural Experiment Station. (Surveys, Parasite colonization and field status)

Louisiana:
- Department of Agriculture and Immigration. (Surveys)

Maine:
- State Department of Agriculture. (Surveys)
- Agricultural Experiment Station. (Parasite field status)

Maryland:
- State Department of Agriculture. (Surveys, Parasite colonization and field status)
- Agricultural Experiment Station. (Surveys, Parasite colonization and field status)

Massachusetts:
Agricultural Experiment Station, Amherst. (Surveys)

Michigan:
Agricultural Extension Service. (Parasite field status)

Minnesota:
State Department of Agriculture. (Surveys, Distribution records)
Agricultural Experiment Station. (Parasite colonization, parasite field status, resistance investigations)

Missouri:
State Department of Agriculture. (Distribution records)
Agricultural Experiment Station. (Surveys)

Nebraska:
Agricultural Experiment Station. (Surveys)

New Hampshire:
State Department of Agriculture. (Parasite field status)
Agricultural Experiment Station. (Surveys)

New Jersey:
State Department of Agriculture. (Surveys, Parasite colonization)
Agricultural Experiment Station. (Parasite colonization)

New York:
State Department of Agriculture. (Surveys, Parasite colonization)
Agricultural Experiment Station, Geneva. (Surveys, Parasite colonization)

North Carolina:
State Department of Agriculture. (Surveys)

North Dakota:
Agricultural Experiment Station. (Surveys)

Ohio:
Agricultural Experiment Station. (Surveys, insecticide and resistance investigations)

Pennsylvania:
Pennsylvania State College. (Surveys, Parasite colonization)
State Department of Agriculture. (Surveys, Parasite colonization)
Agricultural Extension Service. (Parasite field status)

Rhode Island:
Department of Agriculture and Conservation. (Surveys)

South Dakota:
Agricultural Experiment Station. (Surveys)

Tennessee:
State Department of Agriculture. (Surveys)

U. S. Bureau of Plant Industry, Soils, and Agricultural Engineering. (Resistance investigations, Insecticide application equipment)

U. S. Bureau of Entomology and Plant Quarantine, Division of Insecticide Investigations. (Insecticide investigations)

U. S. Bureau of Entomology and Plant Quarantine, Division of Foreign Parasite Introduction. (Parasite colonization)

Vermont:
State Department of Agriculture. (Surveys)

Virginia:
Virginia Truck Experiment. (Surveys, Parasite colonization and field status)
State Department of Agriculture. (Surveys, Distribution records, Parasite colonization and field status)
Agricultural Experiment Station. (Parasite colonization)

Wisconsin:
State Department of Agriculture. (Surveys, Distribution records, Parasite colonization and field status)
Agricultural Experiment Station. (Parasite colonization and field status)

The Agricultural Experiment Stations of a number of States contributed lines of corn for resistance testing.

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EUROPEAN CORN BORER RESEARCH

PROGRAM FOR CALENDAR YEAR 1949

Work Project I-e-3
EUROPEAN CORN BORER INVESTIGATIONS

EUROPEAN CORN BORER RESISTANCE INVESTIGATIONS
Lafayette, Indiana and Toledo, Ohio

Bureau of Plant Industry, Soils, and Agricultural Engineering
Division of Cereal Crops and Diseases
and
State Agricultural Experiment Stations
Cooperating

Bureau of Entomology and Plant Quarantine

Line Project I-e-3-1	Resistant varieties of field corn
Line Project I-e-3-2	Resistant varieties of sweet corn
Line Project I-e-3-3	Factors responsible for resistance
Line Project I-e-3-4	Egg production for use in variety tests

(A. M. Vance, H. R. Painter, L. H. Patch, and Morris Schlosberg, West Lafayette, Indiana; F. F. Dicke and C. A. Crooks, Toledo, Ohio)

Bureau of Plant Industry, Soils, and Agricultural Engineering

Work Project d-1-2	Corn Production, Breeding, Disease and Quality Investigations

(A. M. Brunson and G. M. Smith)

Purdue Agricultural Experiment Station

All of the above projects are conducted in cooperation with the Purdue Station.

PROGRAM FOR CALENDAR YEAR 1949

INVESTIGATIONS AT WEST LAFAYETTE, INDIANA

Dent Corn Resistance (L. H. Patch and A. M. Brunson[1/])

As a result of consultation with corn breeders in Iowa, Illinois, Indiana, and Ohio, work in 1949 will include for the first time in dent corn hand infestations with egg masses of plants in the corn breeders' own plots. In the case of dent corn it is planned to infest about 1,000 ear hills in the plots of R. W. Jugenheimer at Urbana, Illinois, (Experiment A) and other work will be done in the plots of A. M. Brunson at Lafayette, Indiana, (Experiment B). The ear hills at Urbana will include early selections from Sprague's first corn borer synthetic made primarily on the basis of yield when in combination with a common tester. This cooperative work has the advantage of enabling the corn breeder to discard susceptible selections and of indicating to the entomologists those selections that are most resistant to borer survival because of possible transgressive segregation.

Production of Synthetic Resistant Strains

Purpose: To use the recurrent selection method for the isolation of resistant material from synthetics made up of resistant lines. It is the purpose to produce four or more synthetics of unrelated lines so that extractions from the synthetics may be combined as double crosses.

Procedure and Material: Experiment C - In the 1947 report of investigations at Lafayette about 90 lines, seed of which was saved, are listed in the various tables. These were given an early leaf feeding rating of 1 or 2 in 1947 on the basis of 1 (best) to 9 (poorest). In 1948, a total of 58 of the 90 lines, and 3 that were given a rating of 3 in 1947, were given the best ratings on early leaf feeding and seed was saved for future work. The 61 segregating lines and 68 sister lines will be compared in 1949 with standard susceptible lines and the better resistant lines will be crossed for the ultimate production of synthetics.

Experiment D - Another group of 47 lines and 3 sister lines are lines that have been tested once and were given the best ratings in either 1947 or 1948. The lines that get the best ratings for the second time will be crossed in 1949 for the ultimate production of synthetics.

Experiments E and F - Two hundred eighty-eight ear selections of Sprague's first synthetic were planted in 1948 and 36 of them were first choice on the basis of resistance to early leaf feeding. The 36 lots of remnants of the ears used to plant the rows in 1948 have been composited with the idea of planting about an acre in 1949 in isolation for the purpose of letting the plants intercross. These intercrosses will be bulked and a practical sample of seed grown in an increase block in 1950 where each plant would be selfed. The resulting ears will be planted in ear rows in 1951

1/ U. S. Bureau of Plant Industry, Soils, and Agricultural Engineering.

when the rows that get the best early leaf feeding ratings will be intercrossed by bulking the pollen and pollinating the silks on those same rows.

The above procedure in outline is the recurrent selection method as applied to this work. It may be repeated a second or third time until the frequency of genes favorable for the expression of high resistance to borer survival have been concentrated sufficiently. In 1952 the bulked seed from the ears produced in 1951 would be planted in an increase block where each plant would be selfed.

A modification of the procedure in 1949, depending on the availability of egg masses for hand infestation, is as follows: The best plants showing the least amount of borer injury would be tagged and ears from them would be planted in ear rows in 1950. Using hand infestations with egg masses in 1950 the plants in the best rows would be selfed for continuing the work in 1951. It is hoped that the use of this modification would gain some time in arriving at the desired results.

As a method study it is highly desirable to determine the degree it is possible to concentrate genes favorable for the expression of high susceptibility to borer survival as well as high resistance. To bring this phase of the study on the same footing as the resistance phase it is planned (Experiment F) to plant 50 ear rows in 1949 with the seed used to plant the ear rows in 1948, not using remnant seed that the 1948 test showed to be most resistant to early leaf feeding. The pollen from 20 of the most susceptible rows out of the 50 would be bulked and used to pollinate the silks on those same rows. In 1950 the resulting seed would be grown in an increase block and each plant selfed, putting the susceptible and resistant phases of the study on the same footing for continued work.

Experiment G - Two hundred twenty-six ear selections of Hays Golden open-pollinated variety were planted in 1948 and 32 of them were first choice on the basis of resistance to early leaf feeding. The 32 lots of remnants of the ears used to plant the rows in 1948 have been composited. It is planned to follow the same methods with these selections, as is described above for Sprague's first synthetic.

Test of Other Segregating Lines - Experiment H - Work in 1948 included ear rows of lines and single crosses in addition to the segregating lines to be included in experiments C and D. This material contains some promising lines but, with a few exceptions, further testing and observation is necessary before they are either retained or discarded. They are grouped as follows:

		1948 row number
65	F_5 segregates out of P8 x 61-67, P8 x K230, P8 x L317, P8 x L304A, and L317 x K230	(672-741)
57	F_4 segregates out of (WF9 x Mo.458-1)	(474-513)
29	F_4 segregates out of (WF9 x Mo.21A)	(532-619)
14	F_4 segregates out of (WF9 x Mo.22)	(2192-2213)
11	F_4 segregates out of (WF9 x HK59)	(620-638)
11	F_4 segregates out of (WF9 x H10)	(514-531)
8	F_4 segregates out of (WF9 x SSS211-300)	(457-473)
6	Segregates out of (WF9 x Rio Loa)	(334-343)
5	Backcrosses out of (WF9 x P.E.I. 119799) x WF9	(374-378)
3	Backcrosses out of (WF9 x Flour 235) x WF9	(385-387)
17	S_3, S_4, and S_5 out of Midland x WF9	(913-984)
18	Recovered WF9 out of R4 x WF9	(742-752)
13	Recovered 38-11 out of K230 x 38-11	(756-790)
19	F_3 out of (L317 x Rio Loa)	(296-315)
42	F_2 of line 04 crossed on lines H10, H11, 616, 763, P8, 458-1, and J528 crossed on 04, P8, H10, H11, and 458-1 crossed on J528 and H11.	(205-216)
18	S_2 of Eastern open-pollinates	(419-448)
42	Advanced lines of HK59, Flour 235, H10, 616-1-11, N-3-1, Mo.459, L304A, Amargo 41.2504, 617-1-11, H12, and H11.	
5	F_3 out of (41.2504B x Flour 235)	(232-246)
8	F_4 out of (A x 43.615)	(641-651)
3	F_4 out of (38-11 x 43.615)	(659-663)
5	Selfs of Sandberg's Argentina material	(1710-1713)
13	Selfs of Italy open-pollinates	(1790-1802)
10	Selfs of open-pollinates from Australia and Palestine	(1812-1815)
3	Lines from Australia	(1748-1752)
18	Lines from Italian open-pollinates	(1759-1782)
4	Selfs of Saunder's Peru material	(1823)
12	Selfs of Foreign Introductions from Jenkins	(1832-1845)
16	Miscellaneous material	

Cooperative Uniform Inbred Tests and Small Lots to be Tested for the First Time - Experiment I

Purpose: To rate for resistance to corn borer and Diplodia stalk rot.

Procedure: To be planted in double rows and thinned to 10 plants in each row. One row is to be infested with 3 or more egg masses per plant and the other row to be infected with Diplodia organism provided by A. J. Ullstrup. Ratings to be taken on basis of early leaf feeding by corn borer and on basis of longitudinal spread of Diplodia with assistance of A. J. Ullstrup.

Materials: Ninety-two lines listed under cooperative North Central States uniform inbred tests seed of which was provided through A. J. Ullstrup, 5 lines from W. Virginia, and 2 from Kentucky.

Eastern Open-pollinates

Experiment J - Thirteen fields that had been exposed to very severe lodging and breakage were sampled for ears from upright plants in 1944 in the Middle Atlantic States by Dicke and Snelling. This material was infested with the August borers in 1945 but has not been tested for survival of the June borers. It is the purpose to plant ear rows of 10 plants each representing 5 to 10 ears from each of the 13 fields or 116 ears in all. Each plant to be infested with 3 egg masses and the rows rated on the basis of early leaf feeding.

Yield and Borer Tests of 20 Double Cross Hybrids

Purpose: Experiment K - In 1948 yield tests were made in Iowa, Nebraska, and Kansas, of 20 double crosses having lines P8, Hy, and L304A in common and another line in the pedigree. It is the purpose to give yield and borer survival tests of lines 04, J528, 03, 616-1-11-5, SSS278-28, 07, 458-1, WF9, WF9A, H10, and H11 in combination with lines P8, Hy, and L304A. Also (04 x J528) x (P8 x 458-1), a borer-resistant double cross that is predicted to outyield U.S. 13 by 20 bushels, will be included. Also included are 4 double crosses that have line H10 substituted successively in place of lines 04, J528, P8, and 458-1 in the double cross of those lines. Also included are commercial double crosses Ind. 605, Ind. 816, Ind. 813, and borer-susceptible A x 90 as standards for comparison.

Procedure: 2 x 10 hill plots with 4-fold replication. Half of each plot (2 x 5 hills) to be infested with 3 egg masses per plant and yields and borer populations to be taken by subplots to determine, if possible, the amount of reduction in yield caused by the June borers and the relative rates of borer survival.

Survival of Larvae on Dent Corn Growing on Different Soil Types - Experiment L

Purpose: To study borer survival on corn growing on different soil types over a country-area.

Procedure: Plant borer-susceptible A x 90 in a 3- x 10-hill plot in each field or soil type studied where corn is drilled. Plant 5 kernels per hill at same time farmer plants, marking each hill with a small stake. Pull up farmer's corn. Use only 10 hills in center row. Infest with 4 egg masses per plant in all plots as near same time as possible. Take count of egg masses laid naturally and date corn silks. Fertilize with high nitrogen fertilizer half of the plot about 10 days before eggs are to hatch. Note prevalence of predators when and after eggs hatch. Make tests of plant tissue for N, P, and K. Dissect plants to count larvae somewhat before moths emerge from pupae.

Open-pollinate Dent Corn Resistance Tests (Morris Schlosberg)[1/]

Purpose: To explore the germ plasm of open-pollinate varieties of dent corn of domestic and foreign origin for sources of high resistance to the European corn borer.

Procedure: Samples of available open pollinate varieties or their F_2 progenies will be planted in single-row plots and hand infested in the whorl stage with 4 to 6 corn borer egg masses per plant. The materials will be evaluated on the basis of early leaf feeding and internal stalk damage. Plants showing little or no evidence of borer infestation will be selfed for further tests. Work with promising selections will be carried forward by the method of recurrent selection.

Materials: For the work in 1949, 17 foreign introductions of open pollinates were furnished by Max M. Hoover, Regional Coordinator, Primary Introduction Station, Ames, Iowa; 10 domestic open-pollinate varieties were furnished by R. W. Jugenheimer, of the Illinois Agricultural Experiment Station; and 3 domestic open-pollinate varieties were furnished by A. M. Brunson, of BPISAE at the Purdue Agricultural Experiment Station. From 25 to 50 plants of each of these will be tested. In addition, 800 F_2 ear lines of Reid's Yellow Dent were furnished by G. F. Sprague, of BPISAE at the Iowa Agricultural Experiment Station. From 5 to 10 plants of each of these will be tested to evaluate the lines and individual plants showing promise among any of the lines will also be self-pollinated for further tests. In addition, if sufficient egg masses are available at Lafayette, 5 plants in each of the Hoover plots at Iowa will be hand infested. These plots are for seed increase of some 150 recent introductions.

1/ In cooperation with G. F. Sprague and M. M. Hoover, Bureau of Plant Industry, Soils, and Agricultural Engineering.

Oviposition Tests (Morris Schlosberg)

Purpose: To find sources of germ plasm in corn for high unattractiveness to oviposition by European corn borer moths.

Procedure: Test entries will be planted as early as feasible in late April and covered with hotcaps to give the plants the advantage of height to attract moths to the plots. Tests will be made in random blocks, using 8 replications of single-plant hills spaced at 40 inches, totalling 8 plants per entry. Five kernels will be planted per hill and the stand thinned to a single plant. Observations for oviposition will be timed so that any given entry will be examined following 4 nights of egg laying by the moths. The total entries will be conveniently divided to permit daily observations in the plots with a minimum crew. The egg masses will be recorded as small, medium, large or giant, and destroyed. The date of silk emergence will be recorded for each plant and the height of the plant measured at the approximate peak of oviposition. These data will be used to adjust the egg mass populations for the effects of differential plant height and stage of plant development among the entries, using the method of multiple covariance.

Materials: A total of 300 dent corn entries will be tested in 1949 as follows: One unit of 50 entries representing retests of materials from the uniform inbred group tested for oviposition attractiveness in 1948, comprising 22 entries rated 1 and 2, 11 entries showing egg populations close to that required for the 2 rating, 3 entries showing a rating of 3 near the experiment average, 5 entries rated 5, and the following inbred lines of known attractiveness performance: A, R4, C05 (W23), Hy, 38-11, WF9, Tr, P8, and L317. This unit was planned to provide a wide, but balanced, range of unattractive and attractive materials. The tests will also provide for three units of 50 each comprising all available ear-line progenies of entries rated 1 and single entries of those rated 2 among the selections from the corn borer breeding materials in the oviposition tests in 1948; and one unit of 100 entries, mainly representing the new 1949 uniform inbred tests. Inbreds Ill. A, Ia. L317, and Kas. 45 will appear in all units as checks, the first for unattractiveness and the last two for attractiveness. Two popcorn lines rated 1, and 2 lines rated 5, for oviposition attractiveness in 1948, will also be included.

Sweet Corn Resistance (Morris Schlosberg and G. M. Smith[1/])

Purpose: To find sources of germ plasm for high resistance to the survival of European corn borer larvae from open-pollinate varieties; to improve the resistance of inbreds P39 and P51 by transferring resistance factors from known resistant lines; to develop more highly resistant new lines from crosses among known resistant lines (intensification); to develop synthetics from known resistant lines for breeding lines of high resistance; to evaluate breeder's lines for their information and as possible sources of high resistance; and to evaluate the resistance of hybrid S5017-1 x 471-U6.

1/ U. S. Bureau of Plant Industry, Soils, and Agricultural Engineering.

Procedure: Entries will be tested directly in the breeder's nursery or in the corn borer resistance test plots at Lafayette, Indiana. In the breeder's nursery, a sample of 5 plants of each entry, at one end of the plot, will be infested by hand in the whorl stage with 4 to 6 corn borer egg masses per plant. At Lafayette, in the corn borer test plots, a single plot of 10 plants spaced at 20 inches will be provided for each entry, of which 5 plants will be infested by hand. All entries will be evaluated for early leaf feeding and internal stalk damage.

Materials: Nursery plots of G. M. Smith, Lafayette, Indiana: Approximately 500 advanced-generation progenies representing new materials and entries tested in 1948 which were rated from 1 to 4 for internal stalk damage (possible range 1 to 9). The materials selected for testing in the 1949 nursery planting include those carried forward from the corn borer breeding program involving the transference of resistance, the intensification of resistance, and the development of new lines from crosses among known resistant lines, as well as series of ear lines of inbreds S5017-1 and 471-U6 for their improvement in connection with the development of hybrid S5017-1 x 471-U6.

Nursery plots of W. A. Huelsen, Illinois Agricultural Experiment Station, Urbana, Illinois: Approximately 1,200 inbred entries, of Bantam, Country Gentleman, and Evergreen sweet corn lines. The materials will be divided in 3 plantings of approximately 400 entries each at weekly intervals, to facilitate evaluation and selfing.

Corn borer test plots, Lafayette, Indiana: New materials sent in by breeders consisting of open pollinates, hybrids, and inbreds: W. H. Lachman, Mass., 7 entries; Wm. Wiidakas, North Dakota, 18 entries; R. H. Andrews, Wisconsin, 30 entries; R. S. Snell, New Jersey, 14 entries; S. H. Yarnell, South Carolina, 11 entries; W. C. Galinat, Connecticut, 38 entries; S. A. McCrory, South Dakota, small number of entries; and R. G. Rothgeb, Maryland, several entries. The plots will also contain 129 entries of material in the 1949 corn earworm tests furnished by E. V. Walter. In addition, 88 commercial hybrids in the plots of G. M. Smith will be tested for possible use in the resistance program.

Resistant synthetics: The following Bantam inbred lines, now in single-cross combinations, will be combined further in 1949 toward the production of at least two different synthetic strains for the development of new highly resistant lines: Mich. 1828, 1823, 3151, and 3116; Iowa 45, 9, 461, and S5010-9; Minn. 26-34, Wis. 515, and Purdue 613.

Test of hybrid S5017-1 x 471-U6; The relative resistance of the Evergreen hybrid S5017-1 x 471-U6 will be compared with the borer reaction of 2 commercial hybrids of each of Bantam, Country Gentleman, and Evergreen sweet corn. The entries will be tested in 4 replications of random blocks, at an infestation rate by hand of from 4 to 6 egg masses per plant placed in the whorl.

Popcorn Resistance (Morris Schlosberg)[1/]

Purpose: To find sources of germ plasm in corn for high resistance to the survival of larvae of the European corn borer and to evaluate the borer reaction of lines for the information of the breeder.

Procedure: A single sample of 5 plants of each entry will be infested by hand in the whorl stage with 4 to 6 borer egg masses per plant. The corn borer plots will consist of 10 plants each. The entries will be evaluated for early leaf feeding and internal stalk damage.

Materials: Approximately 100 entries will be furnished by J. C. Eldredge of the Iowa Agricultural Experiment Station, for planting in the corn borer plots at Lafayette, Ind., and a limited number of entries will be tested in the nursery plots of O. E. Nelson, of the Purdue Agricultural Experiment Station.

Egg Production (H. R. Painter)

Mass Production of Eggs

Purpose: To provide large numbers of egg masses for manual infestation of corn being tested for borer resistance.

Procedure: Cornstalks heavily infested with larvae are caged in the fall to procure moths in the following season.

Technique of Handling Material

Purpose: To improve techniques of handling larvae and moths in large numbers.

Procedure: Limited laboratory and field experiments.

INVESTIGATIONS AT TOLEDO, OHIO

Resistant Varieties of Field Corn (F. F. Dicke and C. A. Crooks)

Testing of Lines Submitted by State and Federal Agencies

Purpose: Rating experimental and released lines of field corn for relative resistance.

Procedure: Experimental lines and lines released for use in the production of commercial hybrids will be rated for relative resistance and the information made available in a general distribution report. These lines mostly originate from the northern states of the central Corn Belt. As a standard practice 20 plants will be artificially infested and larval feeding point counts will be made about 6 weeks after the infestation is applied. Records on other qualities will be made at or near plant maturity.

1/ In cooperation with O. E. Nelson, Department of Botany and Plant Pathology, Purdue Agricultural Experiment Station.

Exploration Among Lines Extracted from Single Crosses

Purpose: To isolate resistant strains of field corn for tests in breeding programs.

Procedure; Ear to row plots will be planted of several hundred lines extracted from single crosses. A standard of 20 plants will be artificially infested. Plants with indications of low leaf damage will be selfed. The majority of the entries are of Minnesota origin and a duplicate of this group will be planted at Waseca, Minnesota. This is the fourth year of this cooperative arrangement whereby plant selections have been selfed under corn borer infestation at Toledo, Ohio. This material has advanced to the S_6 stage of inbreeding. A similar cooperative project has been initiated with the Division of Cereal Crop and Diseases and the Ohio Agricultural Experiment Station (cooperating) with a series of segregating lines in the Toledo plots.

Development of New Lines from Single Crosses and Selections made in an Isolated Block of Sprague's #1 Corn Borer Synthetic

Purpose: To improve the level of resistance by concentrating factors possessed in different lines of known reaction.

Procedure: In 1948, 35 single crosses involving 20 lines of known reaction were made which will be further combined with other lines or crosses in 1949. The objective of preparing these crosses is to follow through with the recurrent selection method of breeding.

Uniform Inbred Tests

Purpose: To test advanced experimental inbred lines that are being developed by the States of the North Central Region.

Procedure: This group contains approximately 100 lines which are to be planted in single row plots of 30 plants spaced as uniformly as possible. The resistance ratings will be based on a uniform application of artificial infestation.

Tests of Lines Developed at Toledo from Open Pollinates

Purpose: To isolate resistant lines from segregating plant populations.

Procedure: Under uniform application of artificial infestation plants with a low damage indication will be advanced in selfing. This material consists of about 50 entries which have been selfed from 3 to 5 times.

Tests of Toledo-Minnesota Lines Top-crossed with the Single Cross Common Testers (A34 x A171) and (Oh 65 x Oh 84)

Purpose: To determine relative resistance to the corn borer and combining ability of the most promising lines that have been extracted from single crosses between lines resistant to the corn borer and Minnesota and Ohio lines used in commercial hybrids.

Procedure: Some 100 of these crosses will be planted in duplicated plots and artificially infested. The relative resistance will be evaluated by counts of the larval feeding points and the tolerance and general combining qualities will be visually judged and rated.

Tests of Two Uniform Single Cross Comparisons

Purpose: To compare all possible single cross combinations of lines promising for release.

Procedure: Replicated plots of two groups of uniform single cross comparisons (early and medium yellow) are scheduled for tests on corn borer resistance. This consists of the total of 20 inbred lines and 90 single cross combinations. The resistance index will be based on the visual larval feeding points with the supplementary ratings on tolerance and stalk breakage.

Tests of Open Pollinated Varieties and Exotic Introductions

Purpose: Observations on relative reaction under artificially induced corn borer infestation. Selfing plants that indicate a high degree of resistance.

Procedure: Open pollinated varieties have been assembled from several sources and consist of different types of flint and dent corns ranging in maturity from the early northern Indian flints to the tropical flints grown in the South and Central America. Some of the samples available are composites of many varieties that were bulked according to maturity and type and then grown and allowed to open pollinate. A group of lines of Guatemala corn which are being developed in Guatemala under the auspices of Iowa State College will be made available by Dr. Melhus. The size of the plots will depend on the type of material and the amount of seed available.

Experimental Field Corn Material Being Developed at Lafayette, Indiana

Purpose: To duplicate plantings of lines that were developed at Lafayette, thus providing added insurance of obtaining a test.

Procedure: This material will be planted in single row plots. Artificial infestation will be applied in a standard of 10 plants. Records will consist of counts of larval feeding points and supplementary information on tolerance and other characteristics that become evident.

Resistant Varieties of Sweet Corn (F. F. Dicke and C. A. Crooks)

Testing of Lines Submitted by State and Federal Agencies

Purpose: To rate experimental and recently released hybrids and inbred lines developed by State and Federal Agencies.

Procedure: Tests on relative resistance to early summer and artificial infestation. Records will be taken on relative ear infestation on replicated plots as well as associated developmental plant data.

Factors Responsible for Resistance (F. F. Dicke and C. A. Crooks)

Translocation and Linkage Studies

Purpose: To test translocation and linkage lines being developed for locating chromosomes and genes associated with resistance.

Procedure: A group of paired backcrosses will be tested for chromosomal interchanges and several for linkages. These cultures have been prepared for these studies with certain known isolated factors present. Both groups will be tested under uniform artificial infestation and sufficiently replicated for statistical evaluation.

Resistance Factors and Testing Methods

Purpose: To study plant parts attacked with incidental records for evaluating relative resistance by counting larval feeding points.

Procedure: A selected group of 25 inbred lines will be planted in 4 replications and a uniform artificial infestation applied. Studies will be made of larval populations and plant parts attacked. One replication will be used to observe the relative effect of 2-4-D (applied as a pre-emergence spray) on the infestation in different inbreds.

Egg Production for Use in Varietal Tests (F. F. Dicke and C. A. Crooks)

Mass production of Eggs

Purpose: To produce large numbers of egg-masses for aritificial infestation of corn being tested for corn borer resistance.

Procedure: Cornstalks heavily infested with corn borer larvae are caged in the fall to produce moths the following season. Moths are collected, placed in oviposition cages; eggs are laid on wax paper, cut, pinned, and placed on plants to secure a uniform infestation to testing material.

INSECTICIDE INVESTIGATIONS
Toledo, Ohio

Line Project I-e-3-5	Insecticidal materials, laboratory tests
Line Project I-e-3-6	Insecticidal sprays, field tests[1/]
Line Project I-e-3-7	Insecticidal dusts, field tests[1/]
Line Project I-e-3-8	Insecticide application equipment[1/]

(C. H. Batchelder, D. D. Questel, and R. V. Connin, Toledo, Ohio)

Insecticidal Materials, Laboratory Tests (D. D. Questel and R. V. Connin)

Tests of New Materials at Toledo, Ohio

Purpose: To test new materials furnished by the Division of Insecticide Investigations and by manufacturers to provide additional toxic agents for field trials against the European corn borer.

Procedure: The usual standard technique with corn leaves as the host and glass tubes as the cages will be used. Those materials showing promise in these laboratory tests will be tested in the field the following season.

Insecticidal Sprays and Dusts, Field Tests (C. H. Batchelder)

Residue Sampling Tests; Determination of Adequate Sample

Purpose: To determine the number of plants to be taken from treatment plots for analysis in determining the amount of insecticide residues present.

Procedure: Apply DDT spray suspensions at dosage rates of 1 and 2 lbs. per acre to sweet corn. Take samples 2 weeks in advance of harvesting as follows: from each of 5 points in treated field take 40 plants and make up 40, 5-plant samples, cut stalks into one to 4-inch sections, dry to 15-25 percent moisture, ship to Beltsville in paper bags. Upon return of residue analyses determine number of plants required for an adequate sample by computing deviation and error.

1/ Conducted in cooperation with the Bureau of Plant Industry, Soils, and Agricultural Engineering, Division of Farm Machinery, Pest and Plant Disease Control Machinery Laboratory, Toledo, Ohio.

Residue Sampling Tests; Determination of Losses in Handling

Purpose: To determine amount of residue losses, if any, during handling of corn plants before shipment.

Procedure: Insert two levels (.1 and .2 grams) of 50 percent DDT into 5 plants in whorl stage. Cut whole plant, section and air-dry for shipment. In another series of 5 plants cut whole plant, section, add DDT in same amounts, and air-dry for shipment to Beltsville for analysis.

Residue Sampling in Experiment Field Plots

Purpose: To determine amount of hazardous residues.

Procedure: Take adequate samples from plots treated with sprays and dusts for analysis at Beltsville laboratory.

Residues in Silos

Purpose: To determine residue on fodder.

Procedure: Take samples from treated field and sweet corn at time of last application and at 14-day intervals until harvest for ensilage. Samples from silos containing treated corn to be taken at monthly intervals between October and April. Treated corn which is not to be ensiled will be sampled at 30 day intervals until crop is consumed or turned under.

Insecticidal Sprays, Field Tests (D. D. Questel and R. V. Connin)

Analysis of Insecticide Residues

Purpose: To determine the amount of residues left on the corn plants after treatments have been made to control the European corn borer infesting field and canning corn.

Procedure: Adequate samples of whole corn plants will be selected. These will be cut in 4 inch lengths into large paper bags and air-dried for 4 or 5 days before shipping to Washington for analysis. Samples will be taken for each insecticide and each method of application.

Selection of plants will be made on canning corn as soon as the ears have been removed for canning. Field corn samples will be taken about the time the corn is ready for filling the silo and again when the corn is mature enough for grain harvest.

Insecticide Materials and Equipment, Toledo, Ohio (C. H. Batchelder)

Tests of Insecticide Spray and Dust Materials on Market Sweet Corn

Purpose: To determine the relative insecticidal effectiveness of methoxyphenyl trichloroethane, No. 18 (chlordane), parathion, and DDT when applied to early market sweet corn in dust and spray-suspension forms.

Procedure: Using experimental duster and sprayer equipment apply insecticides to 4 replicate plots at a dosage rate of 1.5 lbs. of technical insecticidal material per acre except in the case of parathion which will be applied at the rate of 0.25 lbs. of technical parathion in spray treatments and 0.6 lbs. in the dust treatments. Applications will be made at rates of 15 gallons of spray and 20 lbs. of dust per acre except in one case in which DDT spray will be applied at a rate of 75 gallons per acre.

Tests of Dust Adhesives in Materials Applied to Market Sweet Corn

Purpose: To determine value of adhesive when added to dust insecticides for increasing initial adherence.

Procedure: Apply 7.5 percent DDT dust containing 0.5 lbs. of one each of the following materials: Armour's Sticker, a colloid adhesive, and a wetting agent. Use a 2-row, self-propelled duster for applying each preparation to 4 replicate plots at a rate of 20 lbs. per acre.

Relation of Particle Size to Rate of DDT-Residue Retention

Purpose: To determine whether there is a relation between DDT particle-size and the rate of DDT residue retention on treated plants and whether safe limits might be established for consumption of forage crops.

Procedure: Using DDT ground to particle sizes the major proportions of which are approximately 2, 8, and 16 microns; compare the rates of insecticidal effectiveness and the rates of DDT residue retention when applied in dust and spray form. Samples are to be taken from treated plots for analysis at 10-day intervals from the date of the last application to the time of harvest for consumption by lactating animals.

Equipment Test of Nozzles for Low-Gallonage Spray Application Field-Corn

Purpose: To ascertain what spray-pattern provides the most effective deposits on field corn when applied in the whorl stage.

Procedure: Using 6-row, low-gallonage unit, compare nozzles and nozzle-positioning as follows; (a) one large (SSTJ-8003) vs 2 standard (SSTJ-65015) flat-angle, overhead nozzles, (b) hollow-cone vs flat-angle overhead, and (c) 2 overhead vs 2 at sides of plants. These nozzle tests will be conducted in conjunction with the insecticide tests and the same plots will be utilized for this purpose.

Equipment Test of Nozzles for Dust Applications to Field Corn

Purpose: To ascertain what dust discharge pattern provides the most effective deposits on field corn when applied in the whorl stage.

Procedure: Using a 6-row, duster unit, compare standard nozzles and USDA open-back nozzles of same type in overhead, standard, 30-degree angle-position, (b) standard nozzle arrangement with addition of canopy cover vs without canopy, the comparison to be made in a mid-day application.

Application Rates for Commercial Duster Operation in Field Corn

Purpose: To ascertain the most practical application rate for dusting field corn.

Procedure: Using a 6-row commercial duster, apply 1.5 lbs. of technical DDT per acre at rates of 10, 20, and 40 lbs. per acre.

Tests of Insecticides and Equipment for Use on Field Corn

Purpose: To determine relative effectiveness of low-gallonage sprayer and of duster equipment for applying methoxyphenyl trichloroethane, parathion, and DDT to field corn infested by the first-generation borer.

Procedure: Using a 6-row duster and a 6-row, low-gallonage sprayer apply the materials listed above in a 2-treatment schedule to 4 replicate plots. Apply parathion at a dosage rate of 0.25 lb. in the sprays and 0.6 lbs. in the dusts and other materials at dosage rate of 1.5 lbs. of technical material per acre. Application rates per acre will be 20 lbs. of dust or 10 gallons of spray suspension except in one DDT spray treatment at 25 gals. per acre.

Tests of Insecticides and Equipment for use on Canning Corn

Purpose: To determine relative effectiveness of low-and high-gallonage sprayer and duster equipment for applying methoxyphenyl trichloroethane, parathion, Ryania, and DDT to canning corn infested by the second-generation borer.

Procedure: Using experimental, high-clearance vehicles, apply the materials listed above to 4 replicate plots of each treatment. Apply parathion at a dosage rate of 0.25 lb. in the sprays and 0.6 lbs. in the dusts, Ryania at 6 lbs., DDT at 1.5 lbs., and methoxychlor at 3 lbs. per acre. Application rates will be 20-30 lbs. of dust or 15 gallons of suspension spray per acre except in one DDT spray treatment at 75 gallons per acre.

Insecticide Material and Equipment - Iowa (D. D. Questel and R. V. Connin)

Small Plot Tests of New Insecticides

Purpose: To evaluate the toxicity of insecticides found highly promising in laboratory tests at Toledo, Ohio.

Procedure: Small replicated plots will be treated with hand applications of 4 new insecticides using a wheel barrow sprayer and spray suspensions. The 4 new insecticides are Velsicol Corporation; 104, 118, 447, and E-3277 1,1,1-trichloro-2,2-bis (p-fluorophenyl)ethane 50% in Kaolin. DDT will be used for comparison.

Field Tests in Iowa

Purpose: To determine the most satisfactory insecticides and application techniques for the control of the corn borer in the Corn Belt.

Procedure: It is planned to treat approximately 400 acres of corn in Iowa during the summer of 1949. Both field and canning corn fields will be treated.

Fields containing the highest corn borer populations will be selected for most of these tests.

Spray material will be applied with both ground and aerial equipment. An effort will be made to determine the amount of damage caused to corn plants by insects other than corn borer. In this test a combination spray containing DDT, pyrethrum, and parathion will be applied. One or more fields in which the corn borer is not present will be treated. These treatments will be applied throughout the summer in some cases.

A comparison of various treatment schedules and time of application will be made.

Large scale replicated plots will be harvested to obtain reliable yield data.

Methoxychlor will be tested under large field plot conditions to determine the extent of control obtained with this insecticide which, from the residue standpoint, is less toxic to livestock.

Low Gallonage Treatment of Field Corn

Purpose: To determine whether gallonage rates lower than 15 gallons per acre can satisfactorily control the borer infesting field corn.

Procedure: With a self-propelled boom sprayer and three nozzles per row spray 15, 10, and 5 gallons per acre rates on field corn. When borers are full grown make dissections of corn plants to determine degree of control with each rate. The dosage rate will be kept constant for each gallonage rate per acre.

New High Clearance Sprayer

Purpose: A high clearance sprayer will be obtained to permit treatment of full grown field corn to control second generation infestation in field corn. This experiment has two objectives; first to determine how practical it is to treat second generation infestations with ground machines and second to determine the loss per borer per plant in typical fields in the corn borer area.

Procedure: Select three fields of field corn showing high deposition of first generation eggs and if possible do the same in fields infested by the second generation.

Treat large blocks in each field with each of the following insecticides:

Application and dosage rates

DDT - 50% wettable powder - dosage 3 lbs. in 20-40 gallons water
Methoxychlor - 50% powder - dosage 3 lbs. in 20-40 gallons water
Parathion - 15% powder - dosage 2 lbs. in 20-40 gallons water

Adequate checks will be left in each field but plots, because of their size, will not be replicated within each field.

Dissection of corn plants will be made, when the borers are full grown, to determine the effectiveness of the treatment. In addition yields from large plot samples will be taken to determine the loss caused per borer per plant.

Ground Spray Treatment of Canning Corn

Purpose: To determine the extent of control that can be obtained with self-propelled ground sprayers on corn borers infesting canning corn.

Procedure: Using the same high-clearance sprayer indicated above, spray treatments will be made to canning corn infested by first and second generation corn borers at a 40 to 100 gallons per acre rate. These fields will be treated with DDT, parathion, and methoxychlor.

Dissections should be made in these plots and harvest records will be obtained from both treated and untreated strips to determine the increase in yield caused by the treatment.

Damage Caused by Other Insects

Purpose: To ascertain whether insect populations and injuries from insects other than the European corn borer are reduced by treatments applied for the control of the corn borer.

Procedure: Insect populations other than corn borer will be noted before and after treatments with a combination spray - DDT-Parathion-Pyrethrum and with a recommended DDT spray treatment to be used for comparison. An effort will be made to determine how many other insects are being killed by the corn borer treatment. Part of a field uninfested by borers but infested by other insects will be treated, varying time of treatments and number of applications as shown in table 1.

Table 1.--Application dates for various schedules to determine effects of insecticidal treatment upon insects infesting corn

	June	July	August
1.	1-8-22-29	29	6-13-20-27
2.	1-15-29	29	13-27
3.	15		13
4.			13
5.	15		

Taking Yield Data

Purpose: To determine yield increase in bushels per acre as a result of various treatments and to determine the loss per borer per plant in bushels or percent.

Procedure: Large plots, replicated and extending the length of the field will be harvested and the yields for each treatment weighed. The important factor is to obtain yields large enough to give reliable data.

Yields will be taken in plots utilized for testing treatments for control of first and second generation infestations to determine the loss per borer per plant for each generation.

Comparison of Controls Obtained with Various Types of Equipment

Purpose: To compare the insecticidal effectiveness of a ground sprayer and an airplane sprayer.

Procedure: Treat 8 to 12 row strips across the field, each treatment replicated 3 times with the following equipment.

1. Self propelled, high-clearance boom sprayer.
2. Airplane equipped to spray corn.

These treatments will be made during the first generation in field corn using parathion at the rate of .25 pound per acre.

Dissections will be made to determine borer populations and yield data will be taken at harvesttime.

All tests will be conducted in Iowa in a locality showing the highest oviposition and in the vicinity of a corn canning area.

Insofar as possible studies will be conducted in the vicinity of Muscatine to augment the insecticide investigations.

PARASITE INVESTIGATIONS
(Toledo, Ohio and Moorestown, New Jersey)

Line Project I-e-3-9	Parasite Biology
Line Project I-e-3-10	Parasite Colonization
Line Project I-e-3-11	Parasite Field Status

(K. D. Arbuthnot, Toledo, Ohio; D. W. Jones, S. W. Carter, and R. W. Evans, Moorestown, New Jersey)

Parasite Biology (K. D. Arbuthnot, Toledo, Ohio; D. W. Jones, S. W. Carter, and R. W. Evans, Moorestown, New Jersey)

Biological Studies

Purpose: To add to our knowledge of the biology of the parasites as an aid in planning more efficient release schedules of the species and to explain the reasons for success or failure of the different species in specific localities.

Procedure: Studies of the information accumulated from special study localities and from extensive areas which may show the limitations or requirements for successful establishment and maintainence of the species involved, provide an index for guidance in colonization and distribution of the species, and, evaluation of the adaptability of certain species from various sources.

Whatever time may become available from other phases of the work will be expended in field observations of the seasonal history and development of the parasites and its relation to host biology.

Parasite Colonization (K. D. Arbuthnot, Toledo, Ohio; D. W. Jones, S. W. Carter, and R. W. Evans, Moorestown, N. J.)

Colonization of Exotic Parasite Species

Purpose: To continue the distribution of beneficial parasites over additional parts of the corn borer infested area. To determine the reaction of available parasites in areas where the multivoltine strain of the borer recently has become prevalent. To test available parasites in new environments recently invaded by the borer. To speed up the distribution of available parasites in interested states with their cooperation and at their expense. These objectives apply to (a) such new species of exotic parasites as may become available, (b) retesting of previously tested species from importations, in new areas and environments, and, (c) exotic species now established and abundant in some American areas.

Procedure: Large scale test releases will be emphasized with the aid of cooperating states, especially in areas more recently invaded by the borer, where exotic species have not been tested. States included will be Illinois, Indiana, Iowa, Kentucky, Maryland, Minnesota, and Wisconsin. The results obtained from 1948 fall recovery collections where single- and multiple- colony releases of Macrocentrus gifuensis were made in 1948 will be studied to determine if the latter scheme shows more promise than the former for obtaining establishment of this species. If multiple-colony releases show the greater promise, this plan will be more generally adopted in 1949. Chelonus annulipes will be released in closely spaced colonies in several areas and states. Releases of parasites are also planned in Maine, Missouri, Nebraska, New Jersey, Pennsylvania, South Dakota, and Virginia. The release programs for parasites in each State will be formulated in consultation with the State personnel, utilizing all available information on the status of parasites, abundance of the host and its seasonal history and ecological complexes which may affect the parasite.

Sources of Material: Three sources of exotic parasites for colonization in 1949 are being exploited:

a. Large numbers of hibernating corn borer larvae were collected and placed in cold storage in the fall of 1948. Most of them were taken in central Connecticut and they are expected to provide numerous Horogenes punctorius and Macrocentrus gifuensis, and, a limited number of Lydella stabulans grisescens are expected from fewer corn borer larvae taken in New Jersey.

b. A large scale laboratory breeding program for the production of Chelonus annulipes adults for release is being undertaken at the Moorestown laboratory.

c. Importation of hibernating corn borer larvae from Europe are expected to provide parasites hibernating in them, and, cocoons of Campoplex alkae and Microgaster tibialis have been imported from Europe.

Rearing of Parasites: Parasites for release will be reared from the above material at the Moorestown, New Jersey laboratory utilizing methods adapted to each species.

Shipping of Parasites: Shipments will be made by express, air or rail, whichever is found best suited and most efficient, utilizing special insulating and cooling techniques to insure the release of healthy adult parasites. Common carrier destinations most convenient for receiving shipments will be determined by consulting with State and Bureau personnel who will make the releases.

Releases of Parasites: Most releases will be made by State personnel of cooperating agencies but some will be released by Bureau personnel within reasonable distances of Federal laboratories.

Parasite Field Status (K. D. Arbuthnot, Toledo, Ohio; D. W. Jones, S. W. Carter, and R. W. Evans, Moorestown, N. J.)

Summer Survey

Purpose: To determine the status of well established exotic parasites of the corn borer on the summer generation of the host, continuing a long time study of the relationship between the host and parasites in four localities: East Hartford, Connecticut; Atlantic and Burlington, New Jersey; and Taunton, Massachusetts.

Procedure: In each locality 25 collections of 50 borers each will be taken at the time of first generation host pupation.

Fall Survey

Purpose: To provide information on the current establishment, dispersion, abundance, and effectiveness of parasites as an aid in controlling the pest. The information will be utilized in determining future activities in colonization of parasites and all related procedure.

Procedure: The program for field work will be formulated in consultation with State agencies to obtain the greatest amount of information from the efforts of State and Bureau personnel. The collections will be made according to three schemes of sampling: a.-At special study localities based on an arrangement of sampled areas, continuously for several years to determine fluctuations and interrelations of species and the effect of ecological factors. b.- At all release points to determine establishment and maintainence of parasites. c.- Surveys over extensive areas to determine general distribution and abundance of parasites.

INVESTIGATION OF SEASONAL DEVELOPMENT; SURVEYS OF ABUNDANCE, DISTRIBUTION, AND DAMAGE; AND EFFECTS OF CLIMATIC FACTORS (Toledo, Ohio and Muscatine, Iowa)

Line Project I-e-3-12	Seasonal development
Line Project I-e-3-13	Surveys of abundance, distribution, and damage
Line Project I-e-3-14	Effects of climatic factors, cultural operations, parasites and predators on abundance

(E. W. Beck, Toledo, Ohio; Harvey L. Chada and Charles A. Henderson, Muscatine, Iowa)

Seasonal Development

Investigations at Toledo, Ohio (E. W. Beck)

Purpose: To provide current data on the occurrence and development of the European corn borer.

Procedure: Field observations will be made by various members of the staff in the vicinity of Toledo, Ohio to determine occurrence of pupation, emergence, and oviposition. Observations will consist of sample counts in various types of corn remnants. Seasonal development reports from substations submitted to the Toledo office each week will be summarized and processed for distribution to all members of the staff for their information.

Surveys of Abundance, Distribution, and Damage (E. W. Beck)

Abundance Surveys

Purpose: To determine the abundance of the European corn borer in corn in the relatively heavily infested regions of the United States to provide information upon the status of the insect in 1949. The information will be made available for use in control programs, in formulation of research programs, in determining where to distribute parasites, and in computing damage estimates.

Procedure: The 1949 survey will not differ materially from the 1948 survey. The same procedures will be followed and the same recommendations will be made to all cooperators. In 1948 examinations were made in 635 counties 136 of which were examined by Bureau personnel.

Distribution

Purpose: To determine distribution of the corn borer in the United States.

Procedure: The search for new infestations will be limited to States which request assistance in this work subject to further limitations imposed by availability of personnel and funds.

Damage

Purpose: To estimate the annual loss caused by the corn borer in the United States.

Procedure: Estimates of damage by the European corn borer will be calculated utilizing data obtained in the abundance surveys, the standard indices of damage, and current crop production and value data.

Effects of Climatic Factors, Cultural Operations, Parasites and Predators on Abundance

Investigations at Toledo, Ohio (E. W. Beck)

Purpose: To evaluate quantitatively the effectiveness of cultural practices and imported parasites in controlling the European corn borer including their interactions with major factors contributing to fluctuations in borer populations.

Procedure: Investigations at Toledo will be confined to the study of accumulated data.

Investigations in Iowa (C. A. Henderson and H. L. Chada)

Purpose: To evaluate quantitatively the effectiveness of cultural practices and imported parasites in controlling the European corn borer, including their interactions with major factors contributing to fluctuations in borer populations.

Procedure: This study is to be continued in two previously established 12-square mile areas near Muscatine, Iowa. Little change will be made in the observations. The general procedure will follow that of previous years, with emphasis on determining fall and spring populations, host plant abundance surveys, parasite surveys, relationship of host plant development to the seasonal occurrence of the borer, and the recording of climatological data in each study area.

Observations on Insects Other than Corn Borers, Attacking Corn (H. L. Chada and C. A. Henderson)

Purpose: To provide information to supplement tests with combination insecticides to be used in insecticide investigations on the control of the borer.

Procedure: Observations will be made to determine the more important species of insects causing damage to corn in the Corn Belt. Information will be obtained regarding their abundance, seasonal occurrence, position on the plant seasonally, and other pertinent data which might assist in their control by the use of insecticides applied in connection with corn borer control.

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